TECHNICAL NOTES

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RESTORING MOJAVE DESERT FARMLAND WITH NATIVE SHRUBS

The attached article was written by Robert Slayback, State Agronomist Walt Bunter and District Conservationist Robert Dean as a result of the Antelope Valley Wind Erosion Emergency Watershed Project conducted in 1992 near Lancaster.

This information was presented by Robert Slayback at the 8th Annual Wildland Shrub and Arid Land Restoration Symposium held in Las Vegas, Nevada on October 21, 1993 and at the 25th Annual International Erosion Control Association Conference held in Reno, Nevada on February 17, 1994.

This project showed that our best recommendations for native plants and establishment techniques were successful on these abandoned farmlands. However, we did receive two seasons of above average rainfall during and after the planting that ensured the establishment of the woody species. Further reviews of the planting area will determine long term success.

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ABSTRACT

This 2500 acre project on abandoned farmland in the Antelope Valley, Los Angeles County, was instigated by the February 1991 severe dust storms and hazardous conditions in Lancaster, Palmdale, Rosamond, and nearby Edwards Air Force Base. The project was funded by the Emergency Watershed Program (EWP), administered by the USDA, Soil Conservation Service, and promoted by the local Dust Busters Task Force composed of local, state and federal agencies. The project area was cleared of any Russian thistle, smoothed and deep-furrowed. Barley and Indian ricegrass were drilled into the bottom of the furrows. Fourwing saltbush, desert saltbush, California buckwheat, and California poppy were then aerial seeded over the entire project area. Along a main road and next to a housing development, a double-row, 4-foot sand fence was installed with desert tortoise openings. The project was completed in late May 1992.

Results have been fair to excellent with the barley emerging from the moisture from the initial rains in February and March. The barley and the furrows aided in catching the wind-blown soil particles and greatly reducing the dust from this project area. California buckwheat was the most successful shrub throughout the project area. Fourwing saltbush

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was almost equal in stand to desert saltbush with the latter performing better on the droughty soils. Aerial seeding during windy weather affected the proper distribution of the seed and the resulting scattered stands. This project has been a model for developing a 3 to 5-year more comprehensive, research and demonstration project.

INTRODUCTION

Wind blown dust has been a serious problem in the Antelope Valley of eastern Los Angeles County, California, for many years. The February 1991 severe dust storms caused damage, poor air quality and hazardous driving conditions in the Lancaster, Palmdale, Rosamond, and nearby Edwards Air Force Base areas and brought the efforts of a local group into focus. This local group called the "Dust busters Task Force" was spearheaded by the Antelope Valley Resource Conservation District. They are composed of federal, state, county and local government agencies, civic organizations and private citizens. One of their prime concerns has been the wind blown dust from abandoned farmland, especially upwind from the more populated areas. This condition was aggravated by 5 years of drought.

After the February 1991 storms, it was decided to apply for assistance through the Emergency Watershed Protection (EWP) program administered by the U. S. Department of Agriculture, Soil Conservation Service. An aerial survey by the Los Angeles County Fire Department showed about 4800 hectares (12,000 acres) needing treatment upwind from the above populated areas. It was decided to treat about 1000 hectares (2500 acres) that were more severely denuded and prone to severe wind erosion. One area was adjacent to Antelope Acres, a rural housing development. Rainfall averages 17.5 to 25 centimeters (7 to 10 inches) and occurs during the fall-winter season. Soils were identified as Hesparia sandy loam and Rosamond fine sandy loam, sandy loam, loamy fine sand, loamy sand, and loam. They are very erosive and very droughty which presents problems in revegetation with natural rainfall. This was the first time EWP funding was used to reduce wind erosion.

METHODS

Effective methods to treat this denuded and erosive farmland to control wind erosion have not been tried due to cost and non-use of the land. After discussing farming problems with the local people on the Dust Busters Task Force, it was decided that deep-furrowing and planting native, adapted species would be the best short and long term solution to reducing the severe wind erosion. A sand fence would also be installed along a major roadway and next to a housing development.

Preparation

To prepare the land for furrowing, islands of Russian thistle (*Salsola tragus*) were gathered and burned or burned in place and the area smoothed with graders. Underground irrigation pipelines were not disturbed unless they would interfere with the ripping and furrowing operations. It was decided to furrow, rip and plant in one operation in order to eliminate further breakdown of the soil structure and lower cost of operations. Ripping was done to a minimum depth of 30 centimeters (12 inches) with rippers spaced not less than 60 centimeters (24 inches) nor more than 100 centimeters (40 inches) apart.

Furrowing and Drilling

All furrows were constructed with a minimum depth of 20 centimeters (8 inches) below the mean natural grade. Spacing between furrows was 87.5 centimeters (35 inches) to 100 centimeters (40 inches).

'Seco' and 'Arivat' barley (*Hordeum vulgare*) and Indian ricegrass (*Oryzopsis hymenoides*) were drilled into the bottom of each of the furrows at about 2.5 centimeters (1 inch) deep. Drilling was done in the same pass with the furrowing. The barley was planted at 11.4 kilograms per hectare (10 pounds per acre) and the Indian ricegrass was drilled 2.42 kilograms per hectare (2.2 pounds per acre). The furrowing and drilling started in early February 1992 and was completed at the end of March 1992.

Aerial Seeding

The Los Angeles County Fire Department applied the following species with a helicopter and suspended bucket seeder:

Species	Application Rates
Fourwing saltbush (*Atriplex canescens*)	6.4 kg/ha (5.8 lbs/ac.)
Desert saltbush (*Atriplex polycarpa*)	6.1 kg/ha (5.5 lbs/ac.)
California buckwheat (*Eriogonum fasciculatum*)	4.9 kg/ha (4.4 lbs/ac.)
California poppy (*Eschscholzia californica*)	0.8 kg/ha (.7 lbs/ac.)

Aerial seeding was started in late February 1992 and completed in late May 1992. The wind blew most days that were scheduled for aerial seeding. Seeding was halted when winds reached 16 kilometers per hour (10 miles per hour). Light winds affected the proper distribution of seed on the ground.

Sand Fencing

A double-row, 4-foot, sand fence was installed along Avenue 110 West. Two double rows were installed upwind of the Antelope Acres housing development. Green, high density polyethylene fabric was installed on 6-foot steel posts with three ties per post. Spacing between fence rows was 9.1 meters (30 feet) and posts were installed 1.7 meters (6 feet) apart. Due to the potential of the desert tortoise occurring in the area, 1.7 meter (6 foot) wide angled openings in the fence were installed every 60.6 meters (200 feet). Sand fencing was completed in late May 1992.

RESULTS

General

Overall, the furrowing and planting operations were very successful in reducing the blowing dust and the wind erosion on this 2500 acre project area. Because Russian thistle seed was resident in the planted area, it also took advantage of the excellent seedbed and moisture conditions and produced scattered to heavy stands over the project area. This severe competition from the thistle reduced overall stands of the forb and shrub species. The only planted species not affected by the thistle was the barley which provided good initial wind erosion cover. Rodents were probably the next serious deterrent in establishing the forb, grass and shrub species. They did major damage to the barley and California buckwheat plants which they seemed to prefer. Two years of above average rainfall in the area has provided the excellent establishment and growing conditions for the seeded plants. There were scattered areas that were devoid of any vegetation including Russian thistle which was probably due to soil extremes such as loamy sand or gravelly sandy loam. The deposition of blowing soil on the upwind outer edges of the project could have buried the seed too deep and resulted in poor to no stands of planted species.

Evaluations were made on June 23, 1992, November 24–25, 1992, April 13, 1993, and September 21, 1993.

Species

Barley—Due to its fast germination and initial establishment, this was the most successful species planted. Drilling seed into the bottom of the furrow provided good growing conditions and initial germination was excellent. Two varieties, 'Seco' and 'Arivat', were planted due to a short supply of 'Seco' barley. 'Seco' was superior in providing more growth and seed production. However, the rodents liked the barley and seed and grazed some areas down to the ground. Some volunteer reseeding was evident the second season, but very scattered. Where rodent activity was very heavy, there was little reseeding. One area south of Avenue C looked like a "planted" field with plants up to 0.6 meter (2 feet) with mature seed. No Russian thistle or other planted species were identified in this volunteer stand of 'Seco' barley. The main reason to plant barley, a non-native was to give a fast, initial cover to aid in the reduction of wind erosion and establishment of the native shrub species. It was very successful in this aspect.

California buckwheat—Next to barley, this was the most successful shrub species over the total seeded area of 2500 acres. It was also preferred by the rodents that grazed it severely. In a walking transect over the northeast and southeast sections of the large planting area north of Highway 138 on April 14, 1993, California buckwheat showed about 5.3 plants per square meter (0.5 plants per square foot) with an average height of 14 centimeters (5.6 inches). More new plants were identified in the bottom of the furrows, especially where barley had not reseeded. In reviewing the areas containing droughty phases of Rosamond and Hesparia soils, very few plants were identified. Barley was about the only planted species found in these droughty soils.

Fourwing saltbush—On September 21, 1993, 2-year old plants were up to 1.5 meters (60 inches) high, while first year seedlings were 10–20 centimeters (4–8 inches). As with the California buckwheat, there were many new plants down in the furrows. Initial germination was on top of the furrows. This species, along with desert saltbush, showed very spotty stands which could have been due to the seed dispersal caused by wind conditions at time of aerial seeding. Fourwing seemed to prefer the better soils having higher moisture content.

Desert saltbush—This shrub was better adapted to the droughty phases of the soils and sometimes was the only seeded plant found under the heavy stands of Russian thistle. The rodents did graze this plant, but only slightly. Stands seem to be very scattered, which could have been due to the lower seed germination and the seed dispersal problem in aerial seeding. However, some stands of the fourwing and desert saltbushes were good to excellent which again points to the application success.

California poppy—Scattered stands of poppy came on early and displayed colorful bands of gold. By November 24, 1992, most plants had winter-killed, but some mature seed had been produced. Second-year stands of poppy were not quite as good due to higher competition from seeded species and Russian thistle. Again, the aerial seeding of this species provided uneven distribution and scattered stands.

Indian ricegrass—Initially, only a few scattered plants were identified in the bottom of the furrows. More plants continue to show up from this highly dormant seed. Plants ranged from 15 to 45 centimeters (6 to 18 inches) high with larger plants showing mature seed heads. This plant was the only one found in the area where the furrows had filled in from blowing soil. This species is well adapted to these sandy soils and can germinate from deeper depths. It will be interesting to follow the progress of this plant.

Sand Fencing

The double-row sand fence seemed to be very effective in collecting the wind-blown Russian thistles and an average of one foot of soil on the windward side. Thistles had completely filled the area between the fences and the Desert tortoise openings. On April 14, 1993, several ties had broken loose and portions of the fence were flapping in the wind. Ninety feet of fence along Avenue 100 West had been removed, which eliminated the buildup of Russian thistle on each side of the fencing. Overall, it looks like the fence reduced the wind erosion hazard from Avenue 100 West and the housing development at Antelope acres. Seedings between the fences showed poor establishment due to the heavy concentrations of Russian thistles, either growing or blown there. At the end of two seasons, this polyethylene fabric had stretched from the weight of thistles and in several areas had broken loose from original ties.

CONCLUSIONS

Revegetation of abandoned farmland in the Mojave Desert can be accomplished with proven cultural techniques and conservation and native plant materials. Antelope Valley is an area of low rainfall and two seasons of above precipitation provided good moisture conditions for establishing the grass, forb and shrub species. In the past, we have had poor results in coming up with feasible methods in reducing wind erosion on these types of soils. The cost of this project exceeded $120 per hectare ($300 per acre), but we know now it would have been cheaper to apply all the seed with ground equipment. Aerial seeding is usually more economical on large acreages, but with the light and fluffy seed being applied, the prevailing winds prevented an even distribution of seed and adequate stand of seeded species in some areas. The four aerial-applied species could have been applied in the same operation with the drilling of barley and Indian ricegrass.

Barley was very effective in providing initial wind erosion control, except where the soils were extremely sandy and plants were covered up by the blowing soils. Even though the area received a lot of rodent depredation, most of the shrub species were established in varying stands. California buckwheat was the most successful shrub to be seeded on the total area. Fourwing and desert saltbushes were almost equal in establishment with fourwing preferring the heavier soils and desert saltbush doing well on the drier soils. If a splash of color is needed, California poppy provides this, but does fade out when competition becomes severe. Ultimate stands of the native grass and shrubs will show this method is feasible to revegetate these prior farmlands to a remnant of native plants.

The native shrub seed used on this project was provided from several seed companies that collected seed from similar growth regions, but not too specific in vegetative type which was not required. In a large

planting such as this, large amounts of desired species are hard to locate and seed from similar areas is usually acquired. Geneticists have stated this is not the proper method in restoring natives to an area such as this, but that erosion control plants be planted until a native source of seeds is collected or grown.

The double-row sand fence provided good initial protection to a major road and a portion of the Antelope Acres housing development. Desert tortoise openings in the fence became clogged with Russian thistle and were not very functional after that time.

This project financed mainly by Emergency Watershed Protection funds and cosponsored by the Los Angeles County Fire Department provided successful results in reducing wind erosion on highly erodible soils in the Antelope Valley. Revegetation and restoration of these abandoned farmlands will alleviate the serious health and vehicle hazard problems in the area. This work has stimulated the development of a 3–5 year study which will include research and demonstration projects that will provide effective best management practices for abandoned farmland in Antelope Valley and other similar arid regions.